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The relative effectiveness of two ways of structuring and presenting 24 clock hours of preservice and initial inservice vocational-industrial teacher education lessons was determined by comparing: (1) an integrated lecture-discussion course presented by qualified vocational-industrial teacher educator, with (2) a packaged course consisting of 16 mm sound film presentations followed by group discussions (with related guides and materials). The sample of 30 prospective teachers was randomly enrolled in either a summer or fall section of the course, which subsequently was divided into experimental and control groups. Several statistical analyses were applied to the data. While subjects in the film-discussion groups showed consistent and statistically superior performance on the criterion tests, these differences were not reported as being educationally significant. However, the film-discussion appears to be a more efficient method of instruction since it provides for consistency of presentation with a degree of adaptability and flexibility in discussion and has probable economic and convenience advantages. (CH)

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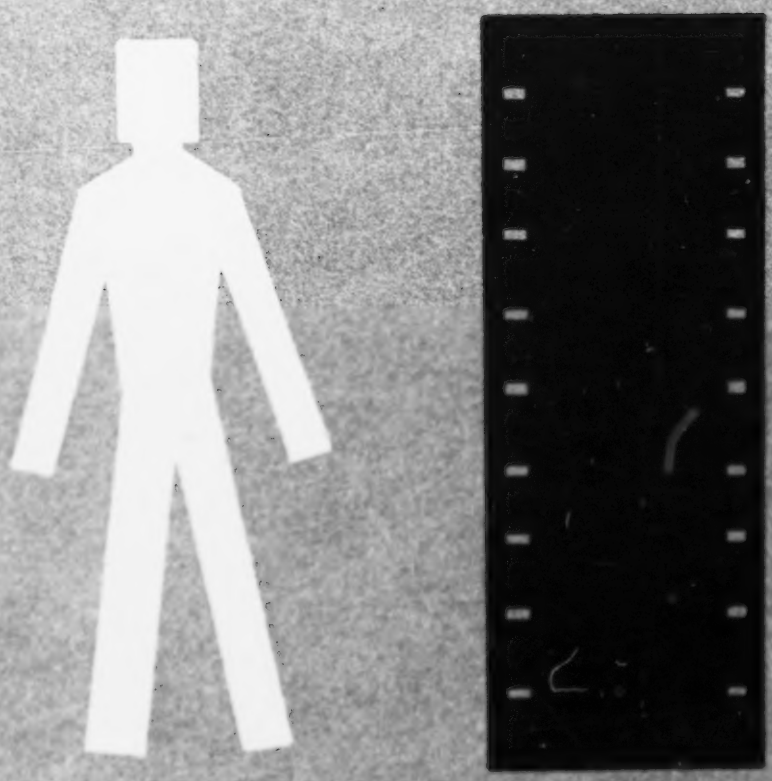

The Relative Effectiveness of Two Ways of Structuring and Presenting Pre-Service and Initial In-Service Vocational-Industrial Teacher Education Lessons

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The problems surrounding the training of new vocational-industrial teachers necessitate optimally efficient and effective instruction. The study reported herein compared the relative effectiveness of two ways of structuring and presenting 24 clock hours of pre-service and initial in-service vocational-industrial teacher education lessons. The findings of the study indicate that a packaged course consisting of 16 mm sound film presentations followed by group discussions (with related guides and materials) was at least as effective as an integrated lecture-discussion course presented by a qualified vocational-industrial teacher educator. Moreover the film-discussion course appears to be a more efficient method of instruction. It provides for consistency of presentation, with a degree of adaptability and flexibility in discussion, and has probable economic and convenience advantages.

The results of the study suggest that improvement be made in the existing film-discussion package and that several states then try-out and evaluate the resultant film-discussion materials (including tv transmission techniques) using both objective and subjective techniques.

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The Research Coordinating Unit would also like to express its gratitude to Mr. Lloyd Scholer and Mr. Kirby Price, the vocational teacher trainers who served as instructors for the study.

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INTRODUCTION

BACKGROUND OF THE PROBLEM

The increase in vocational education programs in Minnesota will cause a severe shortage of qualified vocational teachers. As greater numbers of technically competent workers are recruited for vocational teaching to meet the critical need, the related problem of providing them with minimum basic instruction in the rudiments of teaching becomes equally urgent. The problem of training increased numbers is compounded by the fact that, for optimum effectiveness, instruction cannot be delayed.

To expand the efficiency and effectiveness of the teacher education staff of the Department of Industrial Education, University of Minnesota, a pilot project (4) was conducted to develop and try-out video tape recordings and television transmission of a course designed for pre-service vocational-industrial teacher instruction. The methods and activities engaged in for this project resulted in the following products:

(1) A detailed course of instruction, employing a "Teaching Guide" format for use by the vocational teacher educator, presenting the first course of 12 units covering 24 clock hours of the pre-service teacher education service. (2) A series of achievement tests, including eleven unit tests and one comprehensive final examination, for the measurement of achievement of course and unit objectives. (3) A series of instructional materials, including 12, one-half hour video tapes and sound film copies, complete scripts of video presentations, and sample class handout materials in the form of summaries, charts and activity work sheets. (4) A Seminar Discussion Leader's Guide with suggested methods for using the course materials.

Perhaps the major outcome of this project has been the production of a comprehensive kit of teaching materials covering the 12 basic areas selected as important in vocational-industrial teacher education.

These instructional materials, complete in every way, should make it possible for any knowledgeable coordinator or director of a vocational program to conduct an effective initial 24 hours of teacher training. Inasmuch as there will be multiple copies of these materials produced, there should be the utmost flexibility in their use.*

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* Copies of materials (excluding the films) are available by writing to the Vocational Division, State Department of Education, St. Paul, Minnesota 55101.

STATEMENT OF THE PROBLEM

After reviewing approximately fifteen years of "relative-effectiveness" research on television or film instruction versus various forms of direct, face-to-face methods of instruction, Reid and MacLennan (2) found that the large majority of the studies revealed "no significant differences" between methods. Reid and MacLennan have suggested that a fruitful area for research may be in structuring and organizing the stimulus materials themselves. Comparisons among presentations which simply involve different media are not likely to be very fruitful.

The purpose of the present study was to compare the relative effectiveness of two ways of structuring and presenting 24 clock hours of preservice and initial in-service vocational-industrial teacher education lessons. The two treatments compared were: a) an integrated lecture-discussion course presented by a qualified vocational-industrial teacher educator, and b) a packaged course consisting of 16 mm sound film presentations followed by group discussions (with related guides and materials). The basic content, sequence and length of the lessons were identical for the two treatments and were not evaluated in the present study. The independent variable investigated was the combined effect of structure and mode of presentation, while the dependent variable was initial learning, as measured by eleven unit tests and a final course examination. Subjective evaluations of the two treatments were also collected from the subjects as well as from the teacher trainers.

The study therefore attempted to determine a) whether there were differences in initial learning between two ways of structuring and presenting content, as measured by scores on each of the unit tests and final course examination, and b) whether there were differences in attitudes and opinions among students regarding the two treatments.

PROCEDURES OF THE STUDY

POPULATION AND SAMPLE

Potential instructors for the Area Vocational-Technical Schools of Minnesota are journeymen craftsmen who have expressed an interest in the teaching profession and have been identified through an "Application for Vocational Teacher's Certificate" submitted to the Vocational Division, Minnesota State Department of Education. Potential and beginning vocational instructors, while highly qualified craftsmen, typically lack exposure to or knowledge of teaching methodology. Once identified, however, the potential teacher begins a comprehensive program of instructor training prior to and during his teaching career.

The population for the study consisted of the potential vocational instructors who had been selected by the St. Paul Area Vocational-Technical Institute, during the 1967-68 school year for possible future employment.

A purposive sample of thirty was selected from this pool of potential

instructors by the Coordinator of Curriculum in Teacher Training for the St. Paul Area School on the basis of his instructional needs and the readiness for employment of the prospective teachers. The thirty potential instructors were then randomly enrolled in either a summer or fall section of the teacher training course. Each of the two sections of the course was subsequently divided into an experimental (film-discussion) and control group (live integrated lecture-discussion) with approximately equal numbers of subject randomly assigned to groups. Although all the subjects were present and participated in most of the sessions, test scores for those who missed more than two meetings during the twelve week course were not included in the analyses for treatment effects. The distribution of subjects for which complete data were available is shown in Table 1 as the study sample.

Table 1

STUDY SAMPLE

Summer Section		Fall Section	
Experimental	Control	Experimental	Control
N = 6	N = 5	N = 6	N = 3

Following the random assignment to groups, an "Education and Work History Form" was completed by the subjects. Descriptive information thus obtained is presented in Table 2. Inspection of the data will illustrate that, on the average, the experimental group was slightly older and had a somewhat broader educational and work background than the control group.

A pre-test covering the content of the course was administered to experimental and control groups prior to the beginning of each section. A two-sample "t" test between means on the pre-test revealed no significant differences at the .05 level. The mean scores of both groups indicated that neither had any appreciable knowledge of the content of the course. Data for the analysis are presented in Table 3.

INSTRUCTIONAL METHODS

Experimental and control groups received the same sequence of twelve lessons presented weekly for 12 consecutive weeks during the summer session, 1968. The course was repeated with a second sample of subjects during the fall session, 1968. (Course content is summarized by lesson in Appendix A.)

The experimental treatment utilized the comprehensive kit of teaching materials developed by the staff of the Department of Industrial Education, University of Minnesota. For each 1½ hour weekly meeting of the experimental group, the instructor: (a) briefly reviewed the prior lesson, answering relevant questions from the subjects, and introduced the film presentation, (b) showed the one-half hour film lesson, (c) used the accompanying materials and "Seminar Discussion Leader's Guide" to conduct a one

Table 2

SUMMARY OF EDUCATION AND WORK EXPERIENCE

Characteristics	Experimental (N=12)	Control (N=8)
1. Average Age	36.2	34.3
2. Sex	11 males 1 female	7 males 1 female
3. Educational Experience		
A. High School		
1. Average Highest Grade Achieved	12	11.8
2. Number of High School Graduates	12	7
3. Average Last Year of Attendance	1948	1951
4. High School Curriculum	12 Academic	7 Academic 1 Vocational
B. Post High School Training		
1. Number Enrolled	12	6
2. Average Last Year of High School Attendance	1954	1958
3. Average Amount of College	1.9 Yrs.	1.1 yrs.
4. Number with Formal On-the-Job Training	6	5
5. Number with Company Sponsored Training	5	2
6. Number with Correspondance Course Work	2	1
4. Work Experience		
A. Average Number of Jobs Since High School	5.6	4.5
B. Average Number of Years on Present Job	5.9	3.3
C. Average Total Number of Years of Work	15.7	12.6

Table 3

SUMMARY OF PRE-TEST DATA FOR EXPERIMENTAL AND CONTROL GROUPS

Experimental Group	Control Group
$\bar{x}$ = 9.333 Sd = 4.945 N =12	$\bar{x}$ = 8.375 Sd = 1.187 N = 8

hour seminar discussion on the content of the film lesson, and (d) administered a unit achievement test at the conclusion of the discussion, reviewing the answers following its completion. The experimental group met with the same instructor for 12 consecutive weekly sessions.

The control group met with a second instructor on the same evening, at the same time and location, under similar physical conditions as the experimental group. The control treatment consisted of a face-to-face, integrated lecture-discussion of essentially the same content specified for the experimental treatment. For each of the weekly lessons the instructor was given a copy of the unit test and instructed to (a) present the content embodied in the unit test, (b) give the tests to subjects near the end of the session, (c) review test answers following its completion, and (d) use any sequence, visuals and equipment which he would typically employ or would desire to use in his integrated lecture-discussion presentation. Integrated lecture-discussion consisted of teacher oral presentation mixed with student questions and discussion at psychologically appropriate times.

The two instructors for the course were selected from among the highly qualified and certified vocational teacher trainers on the staff of the Department of Industrial Education. They were chosen on the basis of comparable years of teaching experience, (both secondary and post-secondary vocational teaching), and comparable prior experience teaching the 24 clock hour course. Both instructors were therefore highly familiar with the content of the course, the administrative procedures involved in vocational teacher training, and the typical vocational teacher trainee.

While it was necessary, for administrative and trainee convenience, to offer the course on two different occasions, the distinction between the summer and fall sessions was not of experimental interest to the investigators. Thus, steps were taken to assure equality between the two sessions. An analysis of educational and work history information and pre-test data revealed no significant differences among subjects in the summer and fall sessions. The two instructors taught both summer and fall sessions of the course and were rotated between experimental and control treatments. Assignment of instructors to treatment groups is depicted in Table 4. Thus, it seemed reasonable for analysis purposes to eliminate any distinction between the summer and fall sessions.

Table 4

ASSIGNMENT OF INSTRUCTORS TO GROUPS *

	Summer		Fall	
	Experimental	Control	Experimental	Control
Instructor A	X			X
Instructor B		X	X	

* Note that teacher effect is completely confounded with treatment effect.

INSTRUMENTATION AND COLLECTION OF DATA

Education and Work History Form

Relevant background information for the sample was gathered using an educational and work history questionnaire constructed by the investigators for this purpose. The data obtained through use of the questionnaire has already been presented in Table 2 of the report.

Pretest

A pre-test was constructed by the investigators to assess the naivety and equivalence of the sample with respect to the content of instruction. The investigators studied the film scripts and wrote two, 4-choice, multiple-choice test items for each of the 12 lessons (units). The unit tests and final course examination were reviewed to be sure that the pre-test items did not duplicate items already included on unit or final tests, and the instructors who had filmed each unit were consulted to insure item content validity. The 24 items thus obtained were compiled into a pre-test, representing what was felt to be a range in difficulty, and administered to all subjects at the beginning of the first meeting of the course prior to the start of instruction. A summary of pre-test data has been presented in Table 3 of the report.

Criterion Tests of Initial Learning

The kit of materials used in the experimental treatment of the study included eleven unit achievement tests and a final course examination. Each unit test, consisting of twenty, 4-choice, multiple-choice test items, was written by the instructor who had originally filmed the unit and the tests were used intact as the unit tests for the experimental and control groups in the study.

The original final course examination was made up of sixty, 4-choice items representing items choosen from the eleven unit tests. The final examination was revised and expanded to 84 items by the investigators by interspersing pre-test items throughout the test. The revised final examination was administered to both experimental and control subjects at the conclusion of Unit 12.

The tests employed in the study were designed to be included in the kit of materials accompanying the film course. They were not originally intended for use in assigning grades, therefore, no explicit and consistent effort was made by test-writers to include items which would cause a set of class scores to be dispersed over a wide range and would thus make it possible to easily distinguish among high and low performance. Rather, each test was intended to indicate to a seminar-discussion leader whether or not an acceptable minimum level of understanding of the content covered in a unit had been attained by the group.

This being the case, and considering the fact that the total number of test items as well as subjects were small, it was not unreasonable to find both the variability of the sets of scores on several of the tests and the reliability estimates for those tests to be relatively low. While the investigators were not willing to place a great deal of confidence in the

score for an individual on the several tests with low reliabilities, it appeared reasonable to assume that the group means on the tests were effected less directly and seriously by the low reliabilities. Group means were thus considered to be relatively more stable indicators of performance on the tests and were used in subsequent analyses.

Opinionnaire and Instructors' Reactions

An end-of-course opinionnaire, developed and typically used by the St. Paul Vocational-Technical Institute, was completed by all subjects in the study. The instrument was designed to yield yes/no, anonymous student opinions about various aspects of the two treatments (e. g., personal value of the instruction) and to elicit observations and comments about the content, organization and method of instruction.

Prior to the start of the study, the two teacher trainers were instructed to keep a weekly record of their observations and impressions regarding the content, organization and method of instruction, as well as their perceptions of students' reactions to the courses. The instructor's impressions and reactions were obtained in the form of unit-by-unit narrative reports.

Both student opinions and instructor reactions were helpful in formulating meaningful conclusions, interpretations and recommendations concerning the findings of the investigation.

ANALYSES OF THE DATA

Several statistical analyses were applied to the data. An estimate of whether learning had taken place during instruction was first obtained. For each treatment group, the scores on the pretest (given as a pretest) were compared with the scores for the same group on the pretest items from the final examination (posttest). These differences served as indices of amount of initial learning. The mean of the differences in scores was tested for each group using a two-tailed, matched-pairs "t" test.

Overall differences in initial learning between experimental and control groups were investigated by means of a two-way analysis of variance with repeated measures on subjects within experimental and control groups. (Winer, p. 298.) An unweighted means solution was followed in this analysis in order to adjust for unequal numbers of subjects in experimental and control groups. To determine whether there were significant differences in learning between the two groups for any particular unit (test), post-hoc comparisons between means for the two groups on each of the criterion tests were made using a critical value for the F statistic derived by Scheffé's procedure (Hays, p. 484.) The Sign test (Walker and Lev., p. 430) was employed in an attempt to determine whether differences in performance for experimental and control groups were consistent across the criterion measures. (Did one group -- experimental or control -- perform consistently better across all criterion measures?)

Comments about and subjective evaluations of the two treatments given by subjects and teacher trainers were studied and an attempt was made to summarize the major opinions and/or points of view expressed. Chi Square

and Fisher Exact Probability Tests were used to test for significant differences between observed and expected frequencies of responses given by the two treatment groups.

The investigators also attempted to make some subjective, yet pertinent estimates of the relative costs, practical advantages and limitations of the two courses of instruction.

FINDINGS

EMPIRICAL FINDINGS

Data for the two treatment groups are summarized in Table 5. A two-tailed matched-pairs "t" test for differences between scores on pretest and posttest produced t's of 7.15 and 7.62 for experimental and control groups respectively. Both t's were statistically significant at the .01 level and indicated that, regardless of course of instruction, subjects demonstrated meaningful amounts of initial learning.

Treatment groups were found to differ significantly in overall performance. The analysis of variance comparison of overall differences in initial learning between groups yielded an F of 5.70, which is significant at the .05 level ($F_{.95}$ (1, 18 df) = 4.41). The experimental treatment accounted for approximately 19% of the variability found in test performance between groups ($\text{est}\,\sigma^2_{Y|X} = \omega^2 = .192$).

Inspection of the signed differences between the means presented in Table 5 illustrates that the difference in learning between treatment groups was in favor of the experimental group. The observed frequency of signs was 10 positives and 2 negatives. The Sign Test revealed the probability of observing this distribution of signs by chance to be $p < .038$. Thus, across criterion measures, the experimental group performed consistently better than the control group.

While treatment groups differed significantly in overall performance, no such differences were found when the groups were compared on each of the individual unit criterion measures. Scheffé post-hoc comparisons (critical F value = 7.85) between means for the two groups on each of the twelve tests failed to reveal any significant differences.

SUMMARY OF SUBJECTIVE REACTIONS

Trainee Opinions

Table 6 presents a tabulation of trainee responses to the end-of-course opinionnaire. Chi Square and Fisher Exact Probability Tests indicated that treatment group membership was not significantly related to the way in which subjects responded to questions. However, inspection of the data in the table will show that, in general, both groups responded affirmatively to the questions.

In general, both experimental and control subjects felt that the course was of value to them and that the mode of instruction and related materials

Table 5

SUMMARY OF EMPIRICAL FINDINGS

Tests	Pretest	1	2	3	4	5	6	7	8	9	10	11	Final	Posttest
Experi. $\bar{x}$	9.33	13.50	10.25	10.50	13.67	16.58	13.75	11.83	14.33	13.83	11.92	9.92	27.92	14.42
(N=12) S^2	24.46	4.27	12.21	11.91	13.88	.99	3.30	10.55	6.42	5.61	6.99	4.63	9.54	4.99
Control $\bar{x}$	8.38	11.38	8.63	10.50	9.88	15.00	11.38	11.50	13.38	11.38	9.63	10.13	28.13	14.63
(N=8) S^2	1.41	21.13	8.55	8.29	12.41	5.14	2.84	2.00	3.70	6.84	7.41	4.70	13.55	4.27
Signed Difference	+ .95	+ 2.12	+ 1.62	+ .00	+ 3.79	+ 1.58	+ 2.37	+ .33	+ .95	+ 2.45	+ 2.29	-.21	-.21	

Table 6

TRAINEE RESPONSES TO THE OPINIONNAIRE

Opinionnaire Item	Experimental		Control	
	Yes	No	Yes	No
1. Do you feel that the instruction was of value to you?	16	0	14	0
2. Do you feel that the instruction was presented in a reasonable, efficient way?	14	2	13	1
3. Have you applied any of the skills or knowledge in your work which you learned in the course?	9	7	8	6
4. Did the course of instruction generally cover the material you expected?	11	5	12	2

employed with their group were combined into a reasonable and efficient course.

While experimental subjects rarely made a distinction between the film and seminar-discussion leader in their comments, they did note that the level of vocabulary used in the films was often difficult to understand and that the film instructors' style left something to be desired in poise and effectiveness. Several subjects also expressed doubt about the value of all of the content of the course, but most felt that the mode of instruction, organization and logical sequencing of lessons was "down to earth" and "easily understandable."

Experimental group members commented about the sample handout materials for the course, indicating that they were valuable and would be useful to them in later teaching. Some members of the group observed, however, that answers to questions that arose during the film presentations had to be delayed until the following discussion periods.

By way of contrast, control group subjects limited most of their comments to observations about the instructors' styles and personalities. They did, however, indicate that the course was too short, with too much material presented in the limited time. A longer course, with micro-teaching experiences, was recommended. Also, in contrast to the experimental group, control subjects said that the test questions were ambiguous and that the tests attempted to cover too much material.

Instructor Reactions

Similarities were apparent in the instructors' session-by-session narrative reports and between instructor and trainee reactions to the course. Only the more relevant observations have been briefly summarized below. In general, these observations concern the entire course of instruction; seldom did the instructors make specific comments about the relative effectiveness of the methods of instruction.

The instructors noted the problem trainees experienced with the terminology and definitions used in the films and also indicated that a similar problem was evident in the test materials. Instructors apparently agreed that the content of the film lessons was presented at a level that was more general and academic then could have maximally benefited the sample.

While instructors recognized an increased efficiency with the film treatment, they felt that the highly structured and sequenced presentation gave the impression that the material was inflexible and unadaptable to specific trainee needs. They further indicated that the films "set to rapid a pace" for the students and that, as instructors, they were under great pressure to cover the same amount of content in the face-to-face lecture discussion approach. The quality and quantity of hand-out materials utilized in the filmed-discussion course were considered adequate, but improvement was felt to be desirable and feasible.

Relative Costs of Instructional Approaches

Estimates of the relative costs incurred in the typical use of the two instructional approaches (length of the courses being constant) suggest

that the direct monetary differences would favor the film-discussion approach under the assumption that local school personnel could be used as discussion leaders. Differences in the indirect expenses resulting from availability of instructor and convenience in course scheduling might be of more critical importance.

In the scheduling of a course for the first 24 hours of teacher training, the list of factors in Table 7 might be taken into consideration.

Table 7

COSTS FACTORS RELATED TO COURSE SCHEDULING

Costs	TYPE OF COURSE	
	Film Course	Typical Instructor Course
Instructor		
Salary	X	X
Travel		X
Expenses		X
Schedule		
Availability		X
Convenience		X
Duplication of Materials	X	X

Salary for a discussion leader for the film course (area-vocational school director or other staff person specifically charged with in-service teacher training) would be balanced by the salary of a regular instructor for the typical course. However, travel and other instructor expenses associated with the typical course would either be greatly reduced or eliminated by the film course.

The film course can be conducted at the convenience of the trainees and the institution offering the course. It is possible to offer it at frequent intervals with various size classes. On the other hand, in the case of the typical teacher training approach, much of this convenience is lost. It is frequently necessary for an institution to schedule the course months in advance with indirect inconvenience costs to both institution and trainees.

CONCLUSIONS AND RECOMMENDATIONS

Under the conditions and restrictions imposed by the study it seems reasonable to conclude that:

1.) Both the integrated lecture-discussion and the film-discussion approaches facilitated initial learning

2.) While subjects in the film-discussion group showed consistent and statistically superior performance on the criterion tests, these differences do not seem to be very educationally important.

3.) The film-discussion appears to be a more efficient method of instruction. It provides for consistency of presentation, with a degree of adaptability and flexibility in discussion, and has probable economic and convenience advantages.

The results of the study suggest that it is worthwhile to improve the existing film-discussion package and then to try it out on a much larger scale. To that end, the following steps are recommended.

1.) A viewing panel be utilized to insure content relevance on a national basis to vocational-industrial education and to explore its relevance to the other vocational services.

2.) The specific films used in the present study should be revised. This would include (a) rewriting portions of the script, (b) using experienced actors as presentors, to enhance relevance, appropriateness and pacing, (c) enlarging and simplifying charts and visuals, and (d) improving the technical quality of the films.

3.) The unit tests and final examination should be rewritten with attention paid to (a) ambiguities in questions and alternative responses, (b) level of vocabulary and sentence structure, and (c) item difficulty level.

4.) The number of handouts included in the kit of materials for the film-discussion approach should be increased. Handout items might include carefully chosen samples of completed work sheets, as well as the work sheets presently included for student completion.

5.) Several states can then evaluate the resultant film-discussion materials (including tv transmission techniques) using both objective and subjective techniques.

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APPENDIX A

LIST OF LESSONS COMPRISING THE PRE-SERVICE AND INITIAL IN-SERVICE VOCATIONAL TEACHER EDUCATION COURSE

Unit 1 - Teaching in Vocational-Technical Schools
Unit 2 - Analysis for Instruction
Unit 3 - Organizing Course Components
Unit 4 - Planning the Lesson
Unit 5 - Teaching for Understanding
Unit 6 - Teaching for Motor-Skill Development
Unit 7 - Teaching With Instructional Aids
Unit 8 - Developing Instructional Outcomes
Unit 9 - Evaluating Instructional Outcomes
Unit10 - Developing Evaluative Materials
Unit11 - Managing Teaching-Learning Facilities
Unit12 - Planning Your Teaching Career

APPENDIX B

THE ANALYSIS OF VARIANCE TABLE

Sources of Variation		df	SS	MS	F
Between Subjects		19	551.83		
Treatments	1		132.71	132.71	5.70*
Subjects w. Treat.	18		419.12	23.28	
Subj. w. Treat. 1	11		266.82	24.26	
Subj. w. Treat. 2	7		152.30	21.76	
Within Subjects**		240	772.11	3.22	
Tests	12		641.72	53.48	97.24
Tests x Treat.	12		10.76	.90	1.64
Tests x Subj. w. Treat.	216		119.62	.55	
Total	259				

*Significant at the .05 level ($F_{.95}$ (1,18df) = 4.41)
**Sums of squares within subjects are adjusted for unequal N's